भारतीय मानक
Indian Standard

IS 16525 : 2017
(Reaffirmed 2022)

स्टायरिन ब्युटाडीन स्टायरिन (एसबीएस) सुदृढीकरण के साथ एवं पॉलिएस्टर प्रबलित बिटुमिनस जल सह और नमी सह संशोधित झिल्ली — विशिष्टि

Styrene Butadiene Styrene (SBS) Modified Bituminous Waterproofing and Damp-proofing Membrane with Polyester Reinforcement — Specification

ICS 75.140; 83.120; 91.100.50

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Waterproofing and Damp-proofing Sectional Committee, CED 41

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Waterproofing and Damp-proofing Sectional Committee had been approved by the Civil Engineering Division Council.

Bitumen felt has been used for waterproofing and damp-proofing for more than 65 years and still it is being used. Field experience shows that with the passage of time, cold flexibility of oxidized bitumen felt decreases. It cracks, leading to leakage. Therefore, SBS modified bitumen felt was introduced.

Styrene Butadiene Styrene (SBS) modified membranes with polyester reinforcement in different thickness were introduced in our country first time in the year 1990. Special features of good quality SBS membrane are:

a) Impermeability,

b) Resistance to ageing and weathering,

c) Bonding with base,

d) High temperature stability,

e) Resistance to impact and puncture, and

f) Cold flexibility.

In the formulation of this standard due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

In case a single layer of SBS membrane is adopted, a minimum thickness of 2 mm is suggested. And if more than one layer is used for waterproofing a designated area, the minimum thickness can be mutually decided between the parties concerned, and this shall not be less than 1.5 mm for each of the layers. It may also be borne in mind that, the SBS membranes of thickness less than 3 mm are not suited for torch application as they may get damaged in doing so.

An informative Annex on 'Method of Application' of SBS membranes is provided at Annex D. The Committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STYRENE BUTADIENE STYRENE (SBS) MODIFIED BITUMINOUS WATERPROOFING AND DAMP-PROOFING MEMBRANE WITH POLYESTER REINFORCEMENT — SPECIFICATION

1 SCOPE

1.1 This standard covers the requirements for prefabricated modified bituminous sheet materials reinforced with, polyester fabric as the reinforcement which use styrene butadiene styrene (SBS) thermoplastic elastomer as the primary modifier and are intended for use as a base sheet in the fabrication of water-proofing membranes.

1.2 This is a material specification only. Issues regarding the application techniques are beyond the scope of this standard.

1.3 The specified tests and property limits used to characterize the sheet materials covered by this standard are intended to establish minimum properties.

1.4 The following precautionary statement pertains only to the test method portion of the standard. This standard does not purport to address to all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 CLASSIFICATIONS

SBS membrane may be of thickness ranging from 1.5 mm to 5 mm and may be in plain and mineral finish. For UV resistance, SBS polyester based membrane may be finished with aluminium foil or bituminous aluminium paint or acrylic coating.

4 MATERIALS

4.1 Centre Core

4.1.1 *Polyester Reinforced Membrane*

The reinforcement for polyester based membrane shall be as given in Table 1.

4.2 SBS Polymer

Styrene butadiene styrene modifiers impart a 'plasticizing' quality to bitumen.

4.3 Bitumen

Straight grade bitumen (conforming to IS 73) is to be used and polymerized with adequate quantity of polymer to achieve the complete phase inversion.

4.4 Mineral Filler

It shall consist of finely divided suitable inert mineral matter which passes through 75 microns IS sieve [*see* IS 460 (Part 1)]. The proportion of mineral inert filler will depend upon the type and the weight of membrane manufactured, but shall not exceed 50 percent by weight of the coating material.

Table 1 Requirement of Non-woven Polyester Mat
(*Clause* 4.1.1)

Sl No.	Characteristics	Requirement for Membrane Below 3 mm Thick	Requirement for Membrane 3 mm and Above	Method of Test, Ref to IS 7193
(1)	(2)	(3)	(4)	(5)
i)	Weight, g/m^2	100 ± 10%	160 ± 15%	B-1
ii)	Tensile strength, N/5 cm:			
	a) Longitudinal	300 ± 10%	550 ± 10%	B-2
	b) Transverse	200 ± 10%	300 ± 10%	
iii)	Elongation:			
	a) Longitudinal	25 ± 10%	30 ± 10%	B-3
	b) Transverse	25 ± 10%	30 ± 10%	

4.5 Finishing Material

Product	*Finished with*
SBS Membrane polyester plain finish	Both side with 10 to 15 micron thick thermo fusible polyethylene
SBS Membrane polyester mineral finish	Lower side finished with 10 to 15 micron thermo fusible polyethylene and upper face finished with mineral granule

Product	*Finished With*
SBS Membrane polyester aluminium finish	Lower side finished with 10 to 15 micron thermo fusible polyethylene. Upper side finished with embossed and nitro-cellulose coated aluminium foil of thickness 40 micron

5 PHYSICAL REQUIREMENTS

5.1 Dimensions

SBS membrane shall be supplied in standard width of 1 m (± 1 percent) for all thickness and in lengths of 10/15/20 m (± 1 percent), as defined in Table 2.

5.2 Weight

The weight of the finished SBS membrane for 1 m^2 shall be as specified in Table 2.

5.3 Method

For determining the weight, select at random the number of SBS membrane rolls as indicated in col 3 of Table 3. The randomness of selection is ensured by following the procedure as specified in IS 4905. The average weights of the rolls selected above shall then be taken to represent the weight of rolls in the consignment.

6 OTHER REQUIREMENTS OF APP MEMBRANE

APP membrane when tested in accordance with the appropriate tests shall conform to the requirements given in Table 4.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Sampling

7.1.1 *Lot*

All the rolls of the same grade and from the same batch of manufacture, in one consignment shall constitute a lot.

7.1.1.1 The conformity of the lot to the requirements of this standard shall be determined on the basis of the inspection and tests carried out on the samples selected from the lot.

7.1.2 The number of rolls to be selected from a lot shall depend upon the size of the lot and shall be in accordance with col 3 of Table 3.

7.1.2.1 These rolls shall be selected at random from the lot, and in order to ensure randomness of selection, procedures given in IS 4905 may be followed.

7.1.3 *Test Sample and Number of Tests*

7.1.3.1 All the rolls of selection in **7.1.2** shall be inspected for width, length and visible external defects.

7.1.3.2 The number of rolls to be tested as per Table 4 is in accordance with col 5 of Table 3. These rolls shall be taken at random from those inspected under **7.1.3.1** and found satisfactory for dimension. From each of these rolls, one test sample 2 m long and the full width of membrane shall be cut out for preparing test specimens. Test sample shall not be taken from damaged portion of the roll, if any. The required number of test specimens shall be taken from each of the test samples and subjected to the corresponding tests.

7.1.4 *Criteria of Conformity*

The lot shall be considered to be in conformity with the requirements of the standard, if the following conditions are satisfied:

a) The number of rolls found defective with respect to any characteristic mentioned in **7.1.3.1** does not exceed the corresponding number given in col 3 of Table 3.

b) From the observed values of the breaking strength, the average ($\bar{x}$) and the range (R) are calculated for each direction (that is, warpway and weftway) separately, and the value of the expression $\bar{x} - 0.6\,R$ is found to be greater than or equal to the applicable specified value.

NOTES

1 Average ($\bar{x}$) is the value obtained by dividing the sum of the observed values by the number of observed values.

2 Range R is the difference between the maximum and minimum in a set of observed values.

c) All the sample rolls tested for water absorption shall satisfy the condition of water absorption given in Table 3 individually.

Table 2 Dimensions and Weight of SBS Membrane Polyester (kg/m^2)

(*Clauses* 5.1 *and* 5.2)

Sl No. (1)	Type of APP Membrane (2)	Thickness mm (3)	Total Weight of the Finished Membrane (4)	Method of Test, Ref to (5)
i)	SBS membrane polyester (Plain) (20 m × 1 m)	1.5	1.90 kg ± 5%	Annex B
ii)	SBS membrane polyester (Plain) (15 m × 1 m)	2	2.50 kg ± 5%	
iii)	SBS membrane polyester (Plain and Aluminium) (10 m × 1 m)	3	3.80 kg ± 5%	
iv)	SBS membrane polyester (Mineral) (10 m × 1 m)	3	3.90 kg ± 10%	
v)	SBS membrane polyester (Plain and Aluminium) (10 m × 1 m)	4	5.00 kg ± 5%	
vi)	SBS membrane polyester (Mineral) (10 m × 1 m)	4	5.10 kg ± 10%	
vii)	SBS membrane polyester (Plain and Aluminium) (10 m × 1 m)	5	6.20 kg ± 5%	
viii)	SBS membrane polyester (Mineral) (10 m × 1 m)	5	6.35 kg ± 10%	

d) For all the other characteristics mentioned in **7.1.3.2** (except breaking strength and water absorption), all the test pieces shall satisfy all the requirements of the characteristics individually.

Table 3 Sample Size and Criterion for Conformity
(*Clauses* 5.3, 7.1.2, 7.1.3.2 *and* 7.1.4)

Sl No. (1)	No. of the Rolls in the Lot (2)	No. of Rolls to be Selected in the Sample (3)	Permissible No. of Defective Rolls (4)	Sub-sample Size No. of Rolls to be Selected (5)
i)	Up to 100	5	1	2
ii)	101 to 150	8	1	3
iii)	151 to 300	13	1	4
iv)	301 to 500	20	2	5
v)	501 to 1 000	32	3	6
vi)	1 001 to 3 000	50	5	8
vii)	3 001 and above	80	8	10

8 PACKING

SBS membrane should be securely packed in rolls.

9 STORAGE

In a vertical position with a maximum storage time of one year.

10 MARKING

10.1 Each package shall be legibly and indelibly marked with the following information:

a) Identification of the source of manufacturer;
b) Length, width and weight of the roll; and
d) Batch number in code and date of manufacture.

10.2 BIS Certification Marking

Each package may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 4 Requirements of SBS Membrane
(*Clause* 6)

Sl No. (1)	Test (2)	Requirement for Plain Membrane (3)	Requirement for Mineral Membrane (Including Aluminum) (4)	Requirement for Aluminium Membrane (5)	Unit (6)	Test Method (7)
i)	Thickness of membrane (including mineral granules/aluminium foil:					
	a) Below 3 mm	±5% or *Max* ±0.15 mm	±5% or *Max* ±0.15 mm	±5% or *Max* ±0.15 mm	mm	Measurement
	b) 3 mm and Above	±5% or *Max* ±0.2 mm	±5% or *Max* ±0.2 mm	±5% or *Max* ±0.2 mm	mm	Measurement
ii)	Cold flexibility, °C (All thicknesses)	Does not crack at -15°C	Does not crack at - 15°C	Does not crack at -15°C	°C	IS13826 (Part 2)
iii)	Softening point (All thicknesses)	≥120°C	≥120°C	≥120°C	°C	IS 1205
iv)	Tensile strength, Longitudinal/Transverse:					
	a) Below 3 mm	300 ± 20% 200 ± 20%	300 ± 20% 200 ± 20%	300 ± 20% 200 ± 20%	N / 5 cm @ 23°C	IS13826 (Part 1)
	b) 3 mm and above	650 ± 20% 400 ± 20%	650 ± 20% 400 ± 20%	650 ± 20% 400 ± 20%	N / 5 cm @ 23°C	IS13826 (Part 1)
v)	Elongation, Longitudinal/Transverse:					
	a) Below 3 mm	45 ± 20% 40 ± 20%	30 ± 20% 25 ± 20%	15 ± 10% 15 ± 10%	%	IS13826 (Part 1)
	b) 3 mm and above	40 ± 15% 35 ± 15%	30 ± 15% 25 ± 15%	20 ± 10% 20 ± 10%	%	IS13826 (Part 1)
vi)	Tear strength Longitudinal/Transverse:					
	a) Below 3 mm	Not applicable	Not applicable	Not applicable	NA	Not applicable
	b) 3 mm and above	500, *Min* 300, *Min*	500, *Min* 300, *Min*	500, *Min* 300, *Min*	N	Annex B
vii)	Heat resistance (All thicknesses)	No flow	No flow	No flow	100°C 2 h	IS 13826 (Part 5)
viii)	Penetration @ 25°C, 100 g, 5 s (All thicknesses)	20 ± 5	20 ± 5	20 ± 5	dmm	IS 1203
ix)	Water absorption (All thicknesses)	0.2, *Max*	Not applicable	0.2, *Max*	%	IS 13826 (Part 6)
x)	Dimension stability Longitudinal/ Transverse (All thicknesses)	± 0.5 / ± 0.5	± 0.5 / ± 0.5	± 0.5 / ± 0.5	%	Measurement
xi)	Puncture resistance test (Optional)	Shall show no sign of puncture	Shall show no sign of puncture	Shall show no sign of puncture	—	Annex C

ANNEX A

LIST OF REFERRED INDIAN STANDARDS

(*Clause* 2)

IS No.	*Title*
73 : 2013	Paving bitumen — Specification (*fourth revision*)
460 (Part 1) : 1985	Specification for test sieves: Part 1 Wire cloth test sieves (*third revision*)
1203 : 1978	Methods for testing tar and bituminous materials: Determination of penetration
1205 : 1978	Methods for testing tar and bituminous materials: Determination of softening point
3067 : 1988	Code of practice for general design details and preparatory work for damp-proofing and water-proofing of building (*first revision*)
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
7193 : 2013	Glass fibre base betumen felts— Specification (*second revision*)
13826	Bitumen based felts — Method of test:
(Part 1) : 1993	Breaking strength test
(Part 2) : 1993	Pliability test
(Part 5) : 1994	Heat resistance Test
(Part 6) : 1993	Water absorption test

ANNEX B

(*Table* 2 and *Table* 4)

TEST METHOD

B-1 DETERMINATION OF THICKNESS

B-1.1 Principle

Measurement of the thickness of a non-woven as the distance between the reference plate on which the non-woven rests and a parallel presser-foot that exerts a specified pressure on the area under test.

B-1.2 Apparatus

B-1.2.1 *For Normal Non-wovens*

B-1.2.1.1 Two circular horizontal plates, attached to a stand, comprising an upper plate, or presser-foot, capable of moving vertically and having an area of approximately 2 500 mm^2, and a reference plate having a plane surface of diameter at least 50 mm greater than that of the presser-foot.

B-1.2.1.2 Measuring device, having a scale with 0.01 mm graduations, for measuring the distance between the reference plate and the presser-foot.

B-1.2.2 *For Bulky Non-wovens with a Maximum Thickness of 20 mm*

NOTE — An example of suitable test apparatus is shown in Fig. 1.

B-1.2.2.1 Vertical reference plate, with an area of 1 000 mm^2, presser-foot with an area of 2 500 mm^2, and equipment to suspend the test piece vertically between them.

B-1.2.2.2 Elbow lever, with both arms of equal length, attached to the reference plate and capable of being balanced using a counterweight so that it exerts a very small force to the left when the balance weight is not in position. The geometry of the lever is such that the balance weight gives a measuring pressure of 0.02 kPa.

B-1.2.2.3 Electrical contacts, which, when closed, cause a small bulb to become illuminated.

B-1.2.2.4 Balance weight, with a mass of 2.05 ± 0.05 g which, when in position, causes the contacts to separate and extinguish the bulb.

B-1.2.2.5 Screw, which, when turned, drives the presser-foot to the left and presses the test piece with increasing pressure against the reference plate until the force on the balance is overcome and the bulb becomes illuminated.

B-1.2.2.6 Dial-gauge, to indicate the distance, in millimetres, between the reference plate and the presser-foot corresponding to the thickness of the test piece at the pressure applied.

B-1.3 Preparation and Conditioning of Test Pieces

B-1.3.1 If the method of test [A, B (*see* **B-1.5**)] has not been determined, cut 10 preliminary test pieces, each having an area larger than 2 500 mm^2, and, after conditioning, carry out the procedure described in **8**.

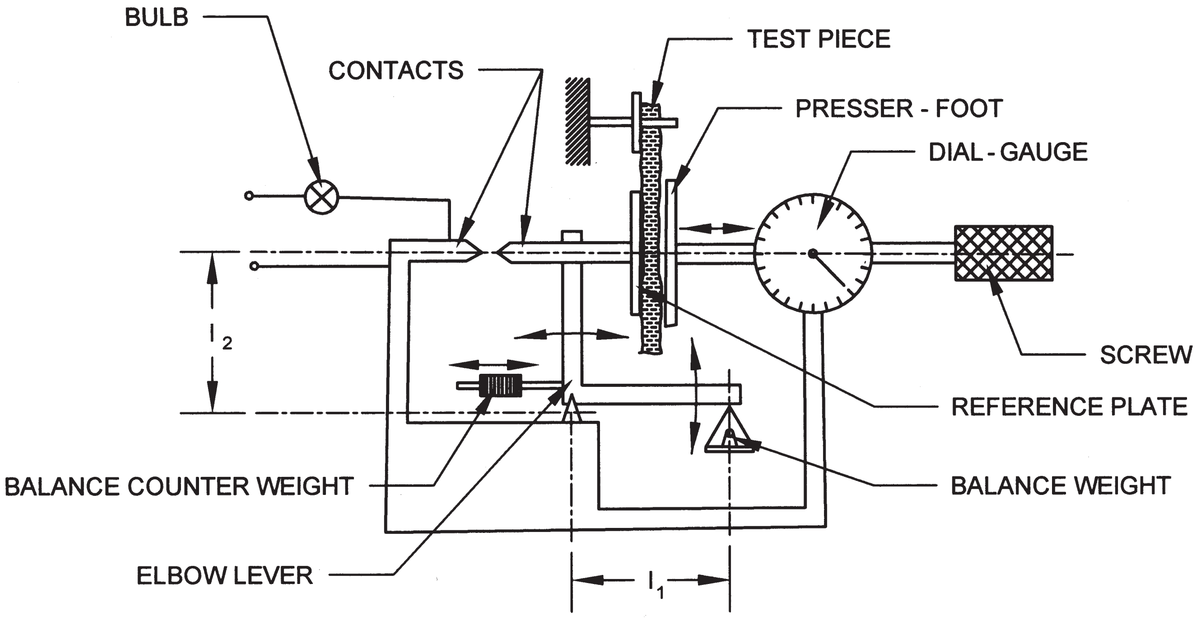


FIG. 1 TEST APPARATUS FOR BULKY NON-WOVENS WITH A MAXIMUM THICKNESS OF 20 mm

B-1.3.2 For normal non-wovens, cut 10 test pieces, each having an area larger than 2 500 mm^2.

B-1.3.3 For bulky non-wovens with a maximum thickness of 20 mm, cut 10 test pieces, each having an area of (130 mm ± 5 mm) × (80 mm ± 5 mm).

B-1.3.4 For bulky non-wovens with a thickness greater than 20 mm, cut 10 test piece, each having an area of (200 mm ± 0.2 mm) × (200 mm ± 0.2 mm).

B-1.4 Preliminary Procedure

B-1.4.1 Carry out the tests in the standard atmosphere for testing.

B-1.4.2 Using the apparatus specified in **B-1.2**, adjust the load on the presser-foot according to the manufacturer's instructions to give a uniform pressure of 0.1 kPa and set the measuring device to zero.

B-1.4.3 Raise the presser-foot and place the preliminary test piece (*see* **B-1.3**) carefully, without tension, on the reference plate. Ensure the test piece is positioned centrally with respect to the presser-foot. Lower the presser-foot carefully until contact is made with the test-piece.

B-1.4.4 Leave in contact for 10 s, adjust the measuring device to measure the thickness of the sample, and note the reading, in millimetre.

B-1.4.5 Repeat the procedure for the other nine test pieces.

B-1.4.6 Adjust the load on the presser-foot according to the manufacturer's instructions to give a uniform pressure of 0.5 kPa and adjust the measuring device to zero. Repeat the measurements on the same 10 test pieces.

B-1.4.7 Calculate the difference between the results at pressures of 0.1 kPa and 0.5 kPa for each preliminary test piece and determine the mean thickness of the non-woven.

NOTE — It is recommended that reference specimens of known thickness are used to check the testing apparatus periodically.

B-1.4.8 Test the non-wovens which were compressed by <20 percent of their thickness in this preliminary procedure in accordance with the procedure given in **B-1.5.1** (Method A) and others in accordance with **B-1.5.2** (Method B), depending upon whether they have a thickness of less than or greater than 20 mm.

NOTE — When different samples, close to the limits of each method, are to be compared, the comparison should be made using the same method.

B-1.5 Procedure

B-1.5.1 *Method A for Normal Non-wovens*

Carry out the tests in the standard atmosphere for testing.

Using the apparatus specified in **B-1.2.1**, adjust the load on the presser-foot according to the manufacturer's instructions to give a uniform pressure of 0.5 kPa and set the measuring device to zero.

Raise the presser-foot, and position the test piece (*see* **B-1.3**) centrally with respect to the presser-foot, and without tension, on the reference plate.

Lower the presser-foot carefully until contact is made with the test piece, and leave in contact for 10 s.

Adjust the measuring device and not the reading, in millimetres.

Repeat the procedure on the other nine test pieces.

B-1.5.2 *Method B for Bulky Non-wovens with a Maximum Thickness of 20 mm*

Carry out the tests in the standard atmosphere for testing.

Using the apparatus specified in **B-1.2.2**, check that the sensitivity and zero are adjusted correctly when the balance weight of 2.05 ± 0.05 g is in position.

Move the presser-foot to the right and fasten the test piece (*see* **B-1.3**) on the bearer pin so that it is suspended between the reference plate and the presser-foot.

Move the presser-foot slowly to the left by means of the screw until the bulb is illuminated.

After 10 s, read the thickness, in millimetres, from the dial-gauge, to the nearest 0.1 mm.

NOTE — If further compression of the test piece during the 10 s, period causes the contact to separate, then presser-foot should be adjusted to illuminate the bulb again before the thickness is read from the gauge.

Repeat the procedure for the other nine test pieces.

B-2 DETERMINATION OF MASS PER UNIT AREA

B-2.1 Principle

Measurement of the area and mass of a test piece and calculation of its mass per unit area in gram per square metre.

B-2.2 Apparatus

B-2.2.1 Apparatus for cutting the test pieces, chosen from among the following.

B-2.2.1.1 *Die*, which cuts a test piece of an area of at least 50 000 mm^2.

B-2.2.1.2 *Template*, with an area of at least 50 000 mm^2 (for example 250 × 200 mm) and a razor blade.

B-2.2.1.3 *Steel rule*, accurately graduated in millimetre, and a razor blade.

B-2.2.1.4 *Balance*, capable of determining the mass of a test piece to an accuracy of ± 0.1 percent of the determined mass.

B-2.3 Preparation and Conditioning of Test Pieces

From each sample, cut at least three test pieces, each of an area of at least 50 000 mm^2, using either the die, or the template and a sharp razor blade.

If there is insufficient material to cut test pieces of the specified size, cut the largest rectangle possible and measure its area using the steel rule.

NOTE — Although it is not recommended, the interested parties may agree on the use of a smaller test area, and this fact should be mentioned in the test report (*see* **B-2.5**).

If the coefficient of variation is required, use a minimum of five test pieces.

B-2.4 Procedure

Determine the mass of each piece in the standard atmosphere for testing using the balance (*see* **B-2.2.1.4**).

B-2.5 Expression of Results

Calculate the mass per unit area of each test piece, the mean value in gram per square metre and, if required, the coefficient of variation, as a percentage.

B-3 DETERMINATION OF TEAR RESISTANCE

B-3.1 Principle

Marking of a trapezoid on a test piece.

Clamping of the non-parallel sides of the trapezoid in the jaws of a tensile testing machine.

Application of a continuously increasing extension to the test piece in such a way that a tear propagates across its width.

Determination of the average maximum tear resistance in newtons.

B-3.2 Apparatus

B-3.2.1 *Tensile Testing Machine*, either constant rate of extension type or constant rate of traverse type, equipped with an autographic recorder to register applied force.

B-3.2.2 *Clamps*, of sufficient width to accommodate the full width of the test piece.

B-3.2.3 *Template*, with dimensions as shown in Fig. 2.

B-3.3 Preparation and Conditioning of Test Pieces

B-3.3.1 Unless otherwise specified, cut five test pieces in the machine direction and five in the cross-machine direction.

NOTE — The edge of the specimen should not normally form part of the test piece.

B-3.3.2 Cut test pieces (75 ± 1) mm × (150 ± 2) mm. Mark each test piece with an isosceles trapezoid using the template. Make a preliminary cut as shown in Fig. 2.

NOTE — Other dimensions, respecting the general proportions of the original test piece, may be as agreed to between the interested parties, especially in order to reproduce some in-use conditions of non-wovens, and should be noted in the test report. The values measured with different test piece dimensions cannot be compared.

B-3.4 Procedure

B-3.4.1 Carry out the testing in the standard atmosphere for testing.

B-3.4.2 At the start of the test, set the clamps (25±1) mm apart and operate the machine at 100 mm/min. Select the force range of the testing machine so that the break occurs between 10 and 90 percent of full scale.

B-3.4.3 Secure the test piece in the machine, clamping along the non-parallel sides of the trapezoid with the cut half-way between the clamps. Hold the short edge taut and let the long edge lie in folds.

B-3.4.4 Start the machine with pawls disengaged, if appropriate, and record the tearing force, in Newtons, on the autographic recorder. If the test piece does not tear at the cut, no result shall be registered.

NOTE — The tearing force will not usually be a single value but will generally appear as a series of maxima and minima.

B-3.5 EXPRESSION OF RESULTS

B-3.5.1 Determine the average value of the series of significant load peaks (*see* Note) represented on the autographic record for each individual test piece for both machine direction and cross direction. In the event that there is only one definite load peak on the autographic record, this value shall be taken as the result for the specimen.

Determine the mean and coefficient of variation of the results for the five test pieces in both the machine and cross directions.

NOTE — The displacement of the clamps is measured with the starting between the clamps at 25 mm. The tear propagation resistance is recorded until the test piece breaks completely, but the results are only valid up to the displacement of the clamps reaching 64 mm. Beyond this value, the measured tear force is reduced by the proximity of the border of the test piece. For this reason, the significant peak loads to be considered are those corresponding to the displacement of the clamps below the limit of 64 mm. Where electronic recording machines are used, it is possible to obtain a mean force for each test piece, which is then averaged to give the final results.

For the same reason as expressed in note above, the mean force should be calculated between the following two limits:

a) The displacement of the clamps corresponding to the first load peak; and

b) The displacement of the clamps equal to 64 mm.

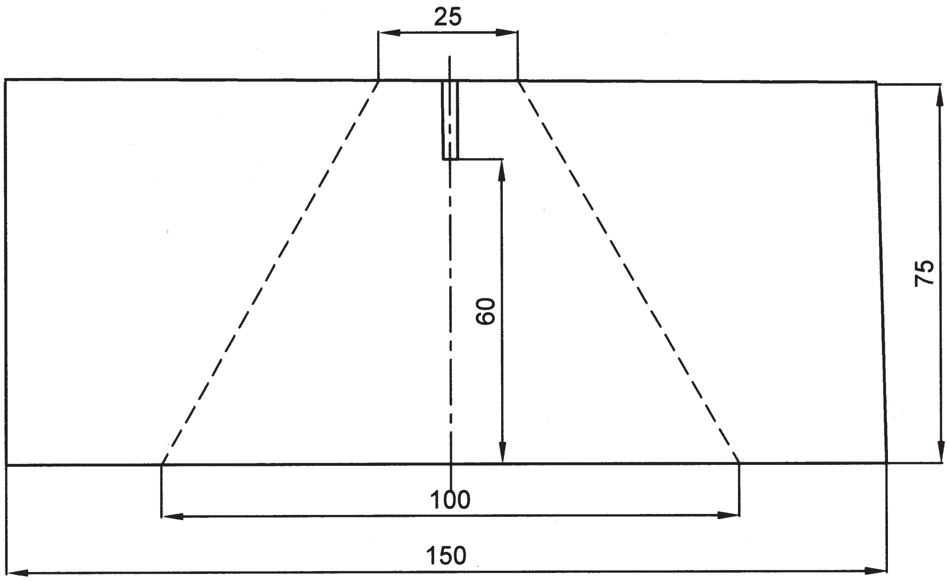


FIG. 2 TEMPLATE FOR TRAPEZOID TEARING TEST

ANNEX C

[*Table* 4, *Sl No.* (xi)]

TEST METHOD RESISTANCE TO PUNCTURE

C-1 SIGNIFICANCE AND USE

C-1.1 One of the important stresses to which sheet materials such as APP membranes used for waterproofing are subjected to is puncture. These data may be used to evaluate the resistance to one type of puncture force on different materials to be considered for a specific construction. The falling dart test as described below may be used to evaluate puncture resistance of the material.

C-1.2 Apparatus

C-1.2.1 *A Square Mounting Frame*, of wood metal, or rigid plastic 254 × 254 mm outside with a 152 × 152 mm central opening, consisting of two parts that are held together with eight thumbscrews on each side. The thickness of wood or plastic shall be 32 mm; of metal, 10 mm. The contact area of each part shall be faced with well-adhered Grade No. 80 sandpaper to prevent slippage of the sheet under test (*see* Fig. 3).

C-1.2.2 *Steel Cylinder*, solid, 25 mm (1 inch) diameter, with the contact face smooth and at 90° with the axis, and with the edge of the end surface slightly rounded.

C-1.2.3 *Conventional Straightedges and Rules or Dials*, to indicate deflection of the test membrane at the edge of the steel cylinder.

C-1.3 Procedure

C-1.3.1 Conduct the tests at a room temperature of 25°C ± 2 °C.

C-1.3.2 Cut three 254 mm^2 specimens of the materials to be tested. Condition specimens to a constant weight at temperature between 22 and 24°C and between 45 and 55 percent relative humidity.

C-1.3.3 Place a single sheet between the upper and lower parts of the mounting frame and tighten the thumbscrews.

C-1.3.4 Make the tests at a room temperature between 22 and 24°C. Support the test frame containing the mounted specimen on all sides on a rigid base high enough to enable the specimen to deflect to its maximum. A circular or a square support may be used. Bring the end the surface of the solid steel cylinder into contact with the sheet being tested. Lower the cylinder at a rate of 6 mm/min, and measure the membrane deflection within 6mm of the edge of the cylinder. Record the membrane deflection and the load periodically. Continue the test until the maximum load is reached.

C-1.3.5 Report the maximum load, the membrane deflection at maximum load, and the type of failure of the sheet.

C-1.3.6 Average the values for the three tests.

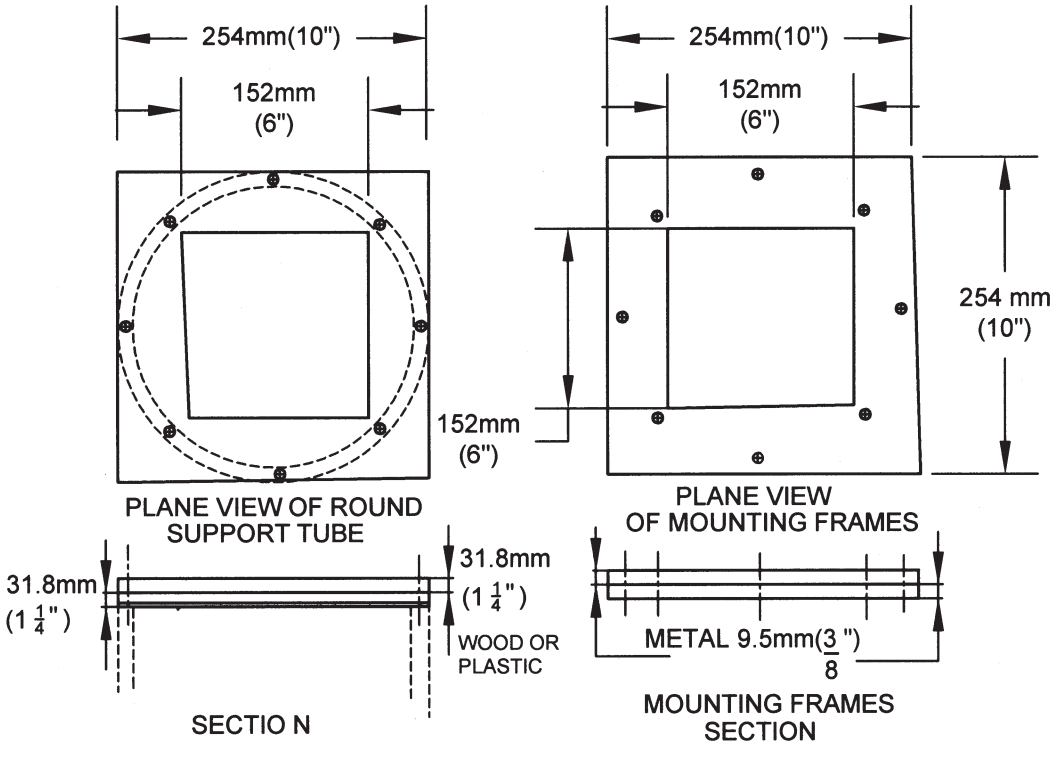


FIG. 3 TYPICAL FRAMES AND ROUND SUPPORT TUBE FOR RESISTANCE TO PUNCTURE TEST

ANNEX D

(*Foreword*)

METHOD OF APPLICATION OF SBS MEMBRANES

D-1 METHOD OF LAYING DAMP-PROOFING TREATMENT

D-1.1 General

The damp-proofing treatment shall be laid in such a way so as to ensure an effective barrier all over against water penetration. For this purpose, the damp-proofing treatment shall be continuous throughout and the overlap joints in membrane, wherever they exist, shall be correctly made.

D-1.2 In addition to the details covered in IS 3067 the following points shall be noted:

a) The site shall be kept free of water by continuous pumping till the whole work and the construction of required structural protection for the damp-proofing treatment is completed. To ensure good adhesion between structural surface and damp-proofing treatment, suitable methods to dry the surface shall be adopted, wherever necessary.

D-1.3 Laying of Membrane

The membrane shall be laid as mentioned below:

a) The membrane shall be first cut to required lengths and laid out flat on a level, dry and clean surface.

b) After the surface had been prepared and the cement rendering and the corner fillets have set and a primer coat has been applied, the strip of membrane prepared for laying is rolled up.

c) The laying shall commence on the floor and shall be completed before treatment is applied to the walls.

d) The rolled up membrane is laid on one end of the floor.

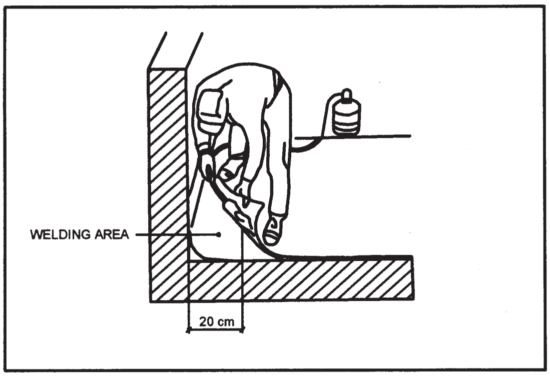
e) After the whole floor has been covered and the overlapping joints properly sealed, the membrane is laid on the vertical face of the walls in a similar manner. In this case the rolls of membrane is held at floor level and then gradually unrolled up the wall face.

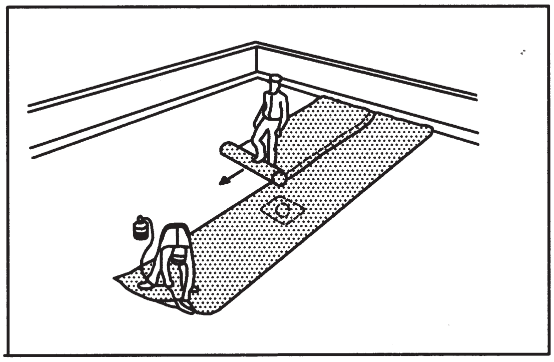
f) The minimum overlapping joints at sides and ends of strips shall be 100 mm and 75 mm.

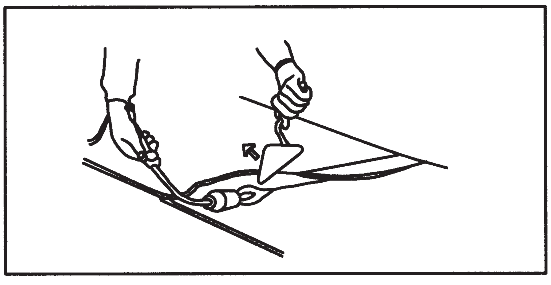
D-1.4 Tools Required

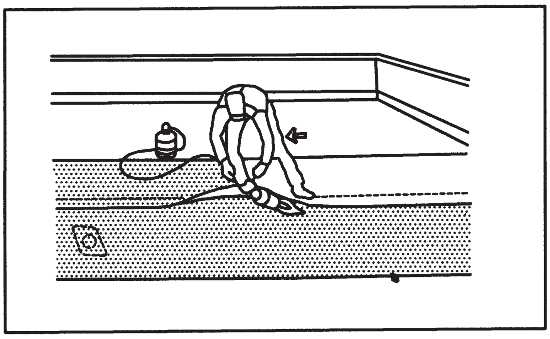
a) Gas torch,
b) Knife,
c) Trowel,
d) Measuring tape,
e) Hand glove, and
f) LPG cylinder.

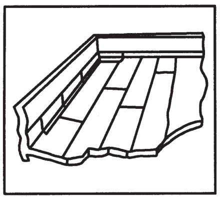
Typical sketches on installation are given below:

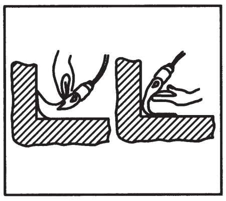


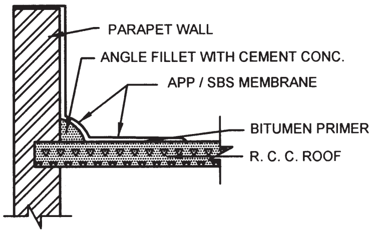




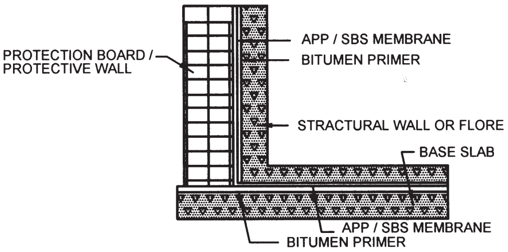






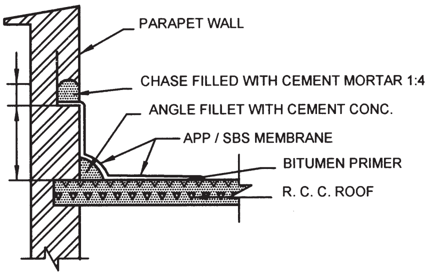


PARAPET WALL 450 mm OR LESS IN HEIGHT
WATER - PROOFING TREATMENT OF JUNCTION OR ROOF AND PARAPET WALL



DAMP PROOF TREATMENT FOR BASEMENT IN
NEW BUILDING UNDER CONSTRUCTION

TITLE :- WATER - PROOFING TREATMENT FOR BASEMENT


PARAPET WALL
CHASE FILLED WITH CEMENT MORTAR 1:4
ANGLE FILLET WITH CEMENT CONC.
APP / SBS MEMBRANE
BITUMEN PRIMER
R. C. C. ROOF

PARAPET WALL OVER 450mm IN HEIGHT

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Waterproofing and Damp-proofing Sectional Committee, CED 41

Organization	*Representative(s)*
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